SD
11
.F58
no.5

524.6

Institute of Northern Forestry
LIBRARY

Serial Library

KETCHIKAN WORKING CIRCLE
FOREST INVENTORY STATISTICS
SOUTH TONGASS NATIONAL FOREST

Forest Survey Report No. 5

(In-Service Use Only)

Forest Service
U. S. Department of Agriculture

Northern Forest Experiment Station
Richard M. Hurd, Director
1962

CONTENTS

	Page
FOREWORD	1
HIGHLIGHTS	
Area	2
Timber volume	3
STATISTICAL TABLES	
Table 1.--Land area by major classes of land and timber management blocks, combined ownerships	6
Table 2.--Area of commercial forest land by ownership class and block	7
Table 3.--Net volume of live sawtimber on commercial forest land by ownership class and block	8
Table 4.--Area of National Forest commercial forest land by block and accessibility class	9
Table 5.--Net volume of live sawtimber on National Forest commercial forest land by block and accessibility class	10
Table 6.--Area of National Forest commercial forest land by stand-size class and block	11
Table 7.--Net volume of live sawtimber on National Forest commercial forest land by stand-size class and block	12
Table 8.--Area of National Forest commercial forest land by forest type and block	13
Table 9.--Net volume of live sawtimber on National Forest commercial forest land by species and block	14
Table 10.-Net volume of all timber on commercial forest land by class of material and species group combined ownership	15
Table 10a.--Net volume of all timber on accessible commercial forest land by class of material and species group, combined ownership	16
Table 10b.--Net volume of all timber on inaccessible commercial forest land by class of material and species group, combined ownership	17

CONTENTS (continued)

Page

Table 11.--Net volume of live sawtimber on commercial forest land by species and diameter classes..... 18

Table 12.--Average net volume per acre to live merchantable trees on commercial forest land by land type and stand-size class..... 19

Table 13.--Gross and net sawtimber volumes, and volumes deducted for defect and breakage, by species..... 20

Table 14.--Total net volume by species and class of material..... 21

APPENDIX

Explanation of terms..... A-1
Species tallied..... A-4
Forest survey procedures
Area estimate A-4
Volume estimate..... A-6
Accuracy of estimates..... A-8
Coefficient of variation A-11
Table of Scribner to International 1/4-inch ratios... A-11
Average form class..... A-11
Causes and types of cull..... A-11
Guides to accessibility..... A-14

```
RETURN,      QUIT        COMPARE      CHECK        EDIT,
    am    wln94-19276     add  01/31/94  --/--/--  02/07/94  WLN-main  WLN-main
        984       ¦ac     ¦0492 SD144.A4K4 1962
        MSG       ¦a      ¦JR / other volumes in series issued by Alaska Forest
                          Research Center.
        040       ¦ac     ¦WaOLN¦WaOLN
        043       ¦a      ¦n-us-ak
        090       ¦ab     ¦SD144.A4¦K4 1962
        24500     ¦a      ¦Ketchikan working circle forest inventory statistics,
                          South Tongass National Forest.
        260       ¦abc    ¦{Alaska} :¦Forest Service, U.S. Dept. of Agriculture,
                          Northern Forest Experiment Station,¦1962.
        300       ¦ac     ¦21, 14 p. ;¦27 cm.
        4901      ¦av     ¦Forest survey report ;¦no. 5
        506       ¦a      ¦Cover title.
        500       ¦a      ¦"In-service use only."
aAU     650-0     ¦azx    ¦Forests and forestry¦Ketchikan Region¦Statistics.
        71020     ¦a      ¦Northern Forest Experiment Station (Juneau, Alaska)
NEW     830-0     ¦av     ¦Forest survey report (Alaska Forest Research Center)
                          ;¦no. 5.
        008   DATE KY= s    DATE1= 1962 DATE2=       PLACE= aku    LAN= eng
      ILLUS=       AUDI=       FORM=   CONTENTS= s
                GOV PUB= f     CONF= 0     FEST= 0    INDEX= 0      FIC= 0
                   BIOG=    MOD REC=      CAT S= d    RULES= a
```

FOREWORD

This is the fifth in a series of reports on the forest area and timber volume of southeast Alaska. Essentially, this report is for the benefit and use of Region 10 of the U. S. Forest Service, in that it summarizes by management blocks, the areas and volumes in National Forest ownership.

The total areas and volumes in this Working Circle will be summarized in a forthcoming report of coastal Alaska.

Contributions to this inventory were made by the Forest Survey (a national program of the Forest Service), by Region 10 of the U. S. Forest Service;, and by the Ketchikan Pulp Company of Ketchikan, Alaska. The aerial photography used was provided by Region 10 and the Ketchikan Pulp Company. The photo interpretation and field work was done in 1957 and 1958.

The following persons contributed to this inventory at one time or another:

Supervision and planning - H. E. Andersen, A. P. Caporaso, E. M. Hornibrook, O. K. Hutchison

Statistical procedures - R. A. Chapman, F. A. Johnson

Photo interpretation: Forest Service: P. M. Haack, A. S. Harris, T. R. Jones. Ketchikan Pulp Company: Thomas Kelley, D. S. Smith.

Field work: U. S. Forest Service: P. M. Haack, A. S. Harris, T. H. Laurent, J. A. Sandor, T. R. Jones. Ketchikan Pulp Company: Kenneth Martinson, Thomas Kelley, Douglas Smith, Milton Philbrook, T. Yocum, I. I. Limata, R. E. Radtke.

Office compilation: R. M. Miller, V. J. LaBau, W. A. Farr, J. T. Bones.

In addition, the Station is grateful for the assistance and cooperation of J. E. Weisgerber and others of the Region 10 staff.

HIGHLIGHTS

Forest Area

The total land area of this Working Circle is 5,566,000 acres. Seventy-four percent of the total area is forested. However, only 46 percent of the forested area is classified as commercial forest land.[1/] The commercial forest land is further classified into accessible and inaccessible stands using the guides given on page A-14 and 15. Twenty-five percent of the forested land, or 1,067,850 acres, is considered to support accessible, commercial forest stands.

How much of the total forest area eventually becomes available for wood products depends not only upon advances in logging engineering, but also upon policy and multiple use planning. The streams and adjacent bodies of salt water support an important fisheries industry. Research has already begun to explore the affects of logging upon the fisheries. This Working Circle also is at the entrance of southeast Alaska and gives the visitor his first impressions of this scenic region. Water, timber, fish, wildlife, historical sites, recreation--these and other considerations will play important roles in determining the resource management directions on this forested area.

Ownership

Because 98 percent of all land and also 98 percent of the commercial forest land is in National Forest ownership, management planning for this Working Circle is largely the responsibility of the Forest Service. Only 109,000 acres of the National Forest land in this unit have definitely been set aside for single uses where timber cutting by commercial sales is prohibited. These reserved areas include the Maybeso Experimental Forest, the Old Tom Creek Natural Area, Old Kasaan National Monument, and Rudyard Bay-Walker Cove Scenic area. An additional 37,000 acres are special uses for the purpose of lighthouse and power sites and for watersheds. Cutting operations on these areas would require restrictions.

1/ See the appendix for definitions of terms.

Other government agencies with a land ownership interest in this unit include the Bureau of Land Management, the Coast Guard, Bureau of Indian Affairs, the Fish and Wildlife Service, and the State of Alaska. There are only about 19,000 acres in homesites, mining claims, townsites, and other private ownerships.

Forest Types

The hemlock type accounts for 57 percent of the commercial forest area, the hemlock-spruce type for another 20 percent, and the Sitka spruce type for 11 percent. Thus, hemlock and spruce predominate on 88 percent of the commercial area. The cedar type is confined to 11 percent of the commercial forest area. Hardwoods, the only other type recognized, is found on one percent of the area.

The hemlock and spruce stands are very evenly distributed over the accessible and inaccessible classifications of commercial forest land area. Cedar is a little more prevalent on the accessible areas, while the hardwoods are mostly on upper levels classified as inaccessible.

The Sitka spruce type is presently the premium or preferred stand of sawmill operators. It is believed that second growth stands will have a higher proportion of spruce. The cedar type represents a current management problem because markets are lacking for cedar logs. While this type presently takes up only 11 percent of the commercial forest area, it becomes more important in the residual stands.

Stand-size Class

There are many references to the mature, overmature, and even decadent forests of southeast Alaska. Classification of the stands by stand-size class helps to measure this condition and points it out vividly in this case.

Ninety-five percent of the commercial forest land is classified as supporting old-growth sawtimber stands. This is evenly distributed over both the accessible and inaccessible areas. Only five percent of the area is distributed in the young growth sawtimber, poletimber, seedling-sapling, and non-stocked stand-size classes. The preponderance of old-growth stands complicates planning for an orderly conversion to second-growth stands.

Timber Volume

There is 64 billion board feet (Scribner scale) of sawtimber on National Forest land in this Working Circle. Of this, 36 billion board feet, or 56 percent, is classified as accessible.

The accessible commercial forest area averages about 34,750 board feet per acre. The inaccessible area averages nearly as much-31,900 board feet.

The volume on the accessible area is rather evenly distributed by blocks, ranging from about 33,600 board feet per acre to about 36,980.

More than 90 percent of the sawtimber volume is western hemlock[2/] and Sitka spruce. These two species account for 61 and 31 percent of the volume respectively. Western redcedar comprises only 4 percent of the volume, while Alaska-cedar, lodgepole pine, red alder, and true fir account for the remaining 4 percent.

The volume is in large diameter trees. Nearly fifty percent of the total volume is in trees 31 inches d.b.h. or over. The spruce is especially large with more than 50 percent of the volume in trees 41 inches d.b.h. or over.

Not only are the trees large, but the stands are mature or overmature. Almost 99 percent of the volume is in these old-growth stands. The remaining, relatively unimportant volume, is in young-growth sawtimber and poletimber stands. Although the young-growth sawtimber stands contribute only a small proportion of the total volume, they have a higher average net volume per acre than any other stand-size class. Undoubtedly this is due to the fact that these stands are short of their pathological rotation.

Summary table of highlights, commercial forest land,
Ketchikan Working Circle, 1957

	Commercial Forest Land			
	Accessible		Inaccessible	
	Area	Net Volume	Area	Net Volume
	Acres*	M. Cu. Ft.	Acres*	M. Cu. Ft.
Total growing stock	1,067,900	7,703,489	890,700	5,892,272
Total sawtimber volume 1/	xxx	7,037,998	xxx	5,384,936
National Forest		MBF Scribner		MBF Scribner
Old-growth sawtimber	989,550	35,600,097	828,350	27,697,167
Young-growth sawtimber	14,700	595,861	5,700	239,068

Percent of Total Board-Foot Volume by Species

Species	Accessible	Inaccessible
Spruce	17.76	12.96
Hemlock	34.98	26.35
Alaska Cedar	1.16	1.67
Red Cedar	2.69	1.69
Other	.07	.67

* Areas include 28,200 acres of Reserved Land - 11,800 acres accessible; 16,400 acres inaccessible.

1/ Includes only volume of sawlog portion of tree.

Table 1.--Land area by major classes of land and timber management blocks, combined ownerships, Ketchikan Working Circle, 1957.

Block	Forest Land				Non-Forest 3/	Total Area
	Commercial			Non-Commercial 2/		
	Accessible	Inaccessible	Total 1/			
	Acres					
1 Kosciusko	70,150	25,150	95,300	29,150	1,700	126,150
2 El Capitan	151,800	23,550	175,350	60,750	14,500	250,600
3 Clam	14,350	3,300	17,650	13,600	850	32,100
4 Whale Pass.	110,250	23,250	141,500	63,500	12,500	217,500
5 Exclusion	4,700	39,200	43,900	51,800	2,000	97,700
6 Twelve-Mile	104,650	18,150	122,800	83,600	16,100	222,500
7 Klawock	70,850	54,400	125,250	174,150	6,100	305,500
8 Skowl	66,650	59,100	125,750	181,550	20,000	327,300
9 Sukkwan	112,450	92,200	204,650	225,500	11,750	441,900
10 Union Bay	20,050	24,900	44,950	31,350	300	76,600
11 Cleveland	18,250	29,400	47,650	40,250	350	88,250
12 Neets Bay	54,650	10,850	65,500	24,400	5,900	95,800
13 Ketchikan	90,350	106,850	197,200	277,000	46,500	520,700
14 Behm	66,600	162,450	229,050	300,800	584,250	1,114,100
15 Boca de Quadra	59,400	154,100	213,500	484,350	290,850	988,700
16 Portland	44,700	63,900	108,600	255,550	296,450	660,600
Total	1,067,850	890,750	1,958,600	2,297,300	1,310,100	5,566,000
Percent of Total	19.19	16.00	35.19	41.27	23.54	100.00

1/ Includes 38,200 acres of reserved land: 6,150 acres in block 6; 1,350 acres in block 8; and 20,200 acres in block 15.

2/ Includes 52,600 acres of reserved land: 4,100 acres in block 6; 2,650 acres in block 8; and 45,850 acres in block 15.

3/ Includes 19,600 acres of inland water in bodies between 10 and 40 acres in size.

Table 2.--Area of commercial forest land by ownership class and block, Ketchikan Working Circle, 1957.

Block	Ownership Class			Total
	National Forest 1/	Other Federal	Other	
	Acres			
1 Kosciusko	95,100	50	150	95,300
2 El Capitan	173,050	-	2,300	175,350
3 Clam	17,650	-	-	17,650
4 Whale Pass.	141,250	-	250	141,500
5 Exclusion	43,900	-	-	43,900
6 Twelve-Mile	122,550	-	250	122,800
7 Klawock	125,100	-	150	125,250
8 Skowl	125,150	-	600	125,750
9 Sukkwan	202,850	1,050	750	204,650
10 Union Bay	44,850	50	50	44,950
11 Cleveland	47,450	-	200	47,650
12 Neets Bay	65,500	-	-	65,500
13 Ketchikan	164,750	30,150	2,300	197,200
14 Behm	228,900	-	150	229,050
15 Boca de Quadra	213,500	-	-	213,500
16 Portland	108,100	100	400	108,600
Total	1,919,650	31,400	7,550	1,958,600
Percent of Total	98.01	1.60	0.39	100.00

1/ Includes 28,200 acres of reserved land: 6,150 acres in block 6; 1,850 acres in 8; and 20,200 acres in block 15.

Table 3.--Net volume of live sawtimber on commercial forest land by ownership class and block, Ketchikan Working Circle, 1957.

Block	Ownership Class			Total	Percent of working circle
	National Forest	Other Federal	Other		
	M Board Feet (Scribner)				
1 Kosciusko	3,244,825	1,840	5,682	3,252,347	4.96
2 El Capitan	5,925,019	-	80,946	6,005,965	9.16
3 Clam	627,279	-	-	627,279	0.96
4 Whale Pass.	4,812,409	-	8,067	4,820,476	7.35
5 Exclusion	1,472,617	-	-	1,472,617	2.24
6 Twelve-Mile	4,162,342	-	9,018	4,171,360	6.36
7 Klawock	4,210,446	-	4,930	4,215,376	6.43
8 Skowl	4,165,439	-	21,513	4,186,952	6.38
9 Sukkwan	6,910,159	38,629	27,253	6,976,041	10.64
10 Union Bay	1,523,392	1,840	1,324	1,526,556	2.33
11 Cleveland	1,638,934	-	7,797	1,646,731	2.51
12 Neets Bay	2,206,129	-	-	2,206,129	3.36
13 Ketchikan	5,529,014	1,067,514	84,631	6,681,159	10.19
14 Behm	7,327,817	-	5,114	7,332,931	11.18
15 Boca de Quadra	7,014,117	-	-	7,014,117	10.70
16 Portland	3,423,154	3,679	13,888	3,440,721	5.25
Total	64,193,092 1/ 97.89	1,113,502 1.70	270,163 0.41	65,576,757	

1/ Includes volume on the reserved forest land.

Table 4.--Area of national forest commercial forest land by block and accessibility class, Ketchikan Working Circle, 1957.

Block	Accessibility Class		Total
	Accessible	Inaccessible	
	Acres		
1 Kosciusko	70,000	25,100	95,100
2 El Capitan	149,550	23,500	173,050
3 Clam	14,350	3,300	17,650
4 Whale Passage	110,000	23,250	141,250
5 Exclusion	4,700	39,200	43,900
6 Twelve-Mile	104,450	18,100	122,550
7 Klawock	70,700	54,400	125,100
8 Skowl	66,300	58,850	125,150
9 Dukkwan	111,050	91,800	202,850
10 Union Bay	19,950	24,900	44,850
11 Cleveland	18,100	29,350	47,450
12 Neets Bay	54,650	10,850	65,500
13 Ketchikan	71,000	93,750	164,750
14 Behm	66,450	162,450	228,900
15 Boca de Quadra	44,400	63,700	108,100
Total	1,043,050	876,600	1,919,650

Table 5.--Net volume of live sawtimber on National Forest commercial forestland by block and accessibility class, Ketchikan Working Circle, 1957.

Block	Commercial Forestland		Total
	Accessible	Inaccessible	
	M Board Feet (Scribner)		
1. Kosciusko	2,445,085	799,740	3,244,825
2. El Capitan	5,168,951	756,068	5,925,019
3. Clam	520,689	106,590	627,279
4. Whale Pass.	4,061,539	750,870	4,812,409
5. Exclusion	173,833	1,298,784	1,472,617
6. Twelve Mile	3,585,564	576,778	4,162,342
7. Klawock	2,462,796	1,747,650	4,210,446
8. Skowl	2,335,060	1,830,379	4,165,439
9. Sukkwan	3,903,331	3,006,828	6,910,159
10. Union Bay	696,435	826,957	1,523,392
11. Cleveland	665,425	973,509	1,638,934
12. Neets Bay	1,869,147	336,982	2,206,129
13. Ketchikan	2,480,653	3,048,361	5,529,014
14. Behm	2,235,166	5,092,651	7,327,817
15. Boca de Quadra	2,118,562	4,895,555	7,014,117
16. Portland	1,509,778	1,913,376	3,423,154
Total	36,232,014	27,961,078	64,193,092
Percent of Total	56.44	43.66	100.00

Table 6.--Area of National Forest commercial forestland by stand-size class and block, Ketchikan Working Circle, 1957.

Block	Stand-size Class: Old Growth Sawtimber (4)	Young Growth Sawtimber (3)	Pole-timber (2)	Seedling & Saplings (1)	Non-Stocked (5)	Total
			Accessible (Acres)			
1. Kosciusko	66,450	-	-	3,550	-	70,000
2. El Capitan	144,600	2,900	1,700	350	-	149,550
3. Clam	14,150	-	-	200	-	14,350
4. Whale Pass.	109,150	6,200	2,000	650	-	118,000
5. Exclusion	4,700	-	-	-	-	4,700
6. Twelve Mile	100,450	1,800	1,850	350	-	104,450
7. Klawock	66,950	-	-	3,750	-	70,700
8. Skowl	62,550	750	-	3,000	-	66,300
9. Sukkwan	105,300	700	-	5,050	-	111,050
10. Union Bay	18,900	-	-	1,050	-	19,950
11. Cleveland	18,100	-	-	-	-	18,100
12. Neets Bay	52,400	900	650	350	350	54,650
13. Ketchikan	68,450	-	1,150	1,400	-	71,000
14. Behm	59,700	750	1,450	4,550	-	66,450
15. Boca de Quadra	56,700	700	-	2,000	-	59,400
16. Portland	41,000	-	700	2,700	-	44,400
Total	989,550	14,700	9,500	28,950	350	1,043,050
Percent of Total	94.87	1.41	0.91	2.78	0.03	100.00
			Inaccessible (Acres)			
1. Kosciusko	22,650	750	1,450	250	-	25,100
2. El Capitan	22,500	1,000	-	-	-	23,500
3. Clam	3,200	-	-	100	-	3,300
4. Whale Pass.	21,900	1,350	-	-	-	23,250
5. Exclusion	38,650	-	-	550	-	39,200
6. Twelve Mile	18,100	-	-	-	-	18,100
7. Klawock	51,950	-	750	1,700	-	54,400
8. Skowl	54,200	-	2,900	1,750	-	58,850
9. Sukkwan	89,550	-	-	2,250	-	91,800
10. Union Bay	24,600	-	-	300	-	24,900
11. Cleveland	29,000	-	-	350	-	29,350
12. Neets Bay	10,150	350	-	-	350	10,850
13. Ketchikan	90,700	-	-	2,400	650	93,750
14. Behm	150,550	750	750	9,700	700	162,450
15. Boca de Quadra	144,650	750	750	7,200	750	154,100
16. Portland	56,000	750	-	6,250	700	63,700
Total	828,350	5,700	6,600	32,800	3,150	876,600
Percent of Total	94.50	0.65	0.75	3.74	0.36	100.00

Table 7.--Net volume of live sawtimber on National Forest commercial forestland by stand-size class and block, Ketchikan Working Circle, 1957.

Block	Stand-size Class: Old Growth Sawtimber (4)	Young Growth Sawtimber (3)	Pole-timber (2)	Seedling & Sapling (1)	Non-Stocked (5)	Total
	Accessible (M board feet, Scribner)					
1. Kosiusko	2,445,085	-	-	-	-	2,445,085
2. El Capitan	5,048,701	113,841	6,409	-	-	5,168,951
3. Clam	520,689	-	-	-	-	520,689
4. Whale Pass.	3,812,445	241,544	7,550	-	-	4,061,539
5. Exclusion	173,833	-	-	-	-	173,833
6. Twelve Mile	3,507,980	70,553	7,031	-	-	3,585,564
7. Klawock	2,462,796	-	-	-	-	2,462,796
8. Skowl	2,301,529	33,531	-	-	-	2,335,060
9. Sukkwan	3,870,106	33,225	-	-	-	3,903,331
10. Union Bay	696,435	-	-	-	-	696,435
11. Cleveland	665,425	-	-	-	-	665,425
12. Neets Bay	1,830,733	35,897	2,517	-	-	1,869,147
13. Ketchikan	2,476,376	-	4,277	-	-	2,480,653
14. Behm	2,196,048	33,597	5,521	-	-	2,235,166
15. Boca de Quadra	2,084,889	33,673	-	-	-	2,118,562
16. Portland	1,507,027	-	2,751	-	-	1,509,778
Total	35,600,097	595,861	36,056	-	-	36,232,014
Percent of Total	98.25	1.64	0.11	0.00	0.00	100.00
	Inaccessible (M board feet, Scribner)					
1. Kosiusko	760,644	33,577	5,519	-	-	799,740
2. El Capitan	716,906	39,162	-	-	-	756,068
3. Clam	106,590	-	-	-	-	106,590
4. Whale Pass.	698,528	52,342	-	-	-	750,870
5. Exclusion	1,298,784	-	-	-	-	1,298,784
6. Twelve Mile	576,778	-	-	-	-	576,778
7. Klawock	1,744,887	-	2,763	-	-	1,747,650
8. Skowl	1,819,356	-	11,023	-	-	1,830,379
9. Sukkwan	3,006,828	-	-	-	-	3,006,828
10. Union Bay	826,957	-	-	-	-	826,957
11. Cleveland	973,509	-	-	-	-	973,509
12. Neets Bay	323,897	13,085	-	-	-	336,982
13. Ketchikan	3,048,361	-	-	-	-	3,048,361
14. Behm	5,056,207	33,673	2,771	-	-	5,092,651
15. Boca de Quadra	4,859,114	33,674	2,767	-	-	4,895,555
16. Portland	1,879,821	33,555	-	-	-	1,913,376
Total	27,697,167	239,068	24,843	-	-	27,961,078
Percent of Total	99.06	0.86	0.08	0.00	0.00	100.00

Table 8.--Area of National Forest commercial forestland by forest type and block, Ketchikan Working Circle, 1957.

Block	Forest Type: Hemlock (H)	Hemlock-Sitka Spruce (H-S)	Sitka spruce (S)	Cedar (C)	Hardwoods (D)	Total
	Accessible (Acres)					
1. Kosciusko	39,000	15,500	10,550	4,950	-	70,000
2. El Capitan	102,600	20,050	3,200	23,350	350	149,550
3. Clam	9,200	2,700	1,300	1,150	-	14,350
4. Whale Pass.	78,200	15,500	2,200	21,750	350	118,000
5. Exclusion	2,050	400	1,300	950	-	4,700
6. Twelve Mile	70,350	11,650	3,550	18,900	-	104,450
7. Klawock	32,750	18,650	13,700	5,600	-	70,700
8. Skowl	34,250	16,550	9,650	5,850	-	66,300
9. Sukkwan	56,750	28,200	16,300	9,800	-	111,050
10. Union Bay	10,650	4,700	2,900	1,700	-	19,950
11. Cleveland	10,450	4,400	1,350	1,900	-	18,100
12. Neets Bay	36,300	7,600	1,950	8,800	-	54,650
13. Ketchikan	35,550	20,150	7,900	7,400	-	71,000
14. Behm	21,100	14,550	19,400	9,200	2,200	66,450
15. Boca de Quadra	25,200	11,700	12,750	9,750	-	59,400
16. Portland	23,050	8,450	7,450	5,450	-	44,400
Total	587,450	200,750	115,450	136,500	2,900	1,043,050
Percent of Total	56.32	19.25	11.07	13.09	0.27	100.00
	Inaccessible (Acres)					
1. Kosciusko	16,550	4,200	1,150	2,950	250	25,100
2. El Capitan	11,650	2,700	-	9,150	-	23,500
3. Clam	2,350	400	1/	400	150	3,300
4. Whale Pass.	10,250	6,700	-	6,300	-	23,250
5. Exclusion	25,000	7,450	3,550	2,700	500	39,200
6. Twelve Mile	8,600	4,900	350	4,250	-	18,100
7. Klawock	32,650	12,500	2,700	4,850	1,700	54,400
8. Skowl	34,500	11,850	3,050	7,700	1,750	58,850
9. Sukkwan	57,700	17,650	5,750	8,450	2,250	91,800
10. Union Bay	16,100	5,050	1,700	1,750	300	24,900
11. Cleveland	17,600	5,000	3,250	3,150	350	29,350
12. Neets Bay	6,800	1,050	350	2,650	-	10,850
13. Ketchikan	52,950	21,850	9,650	6,900	2,400	93,750
14. Behm	86,750	31,700	32,100	6,600	5,300	162,450
15. Boca de Quadra	89,000	30,800	20,300	8,950	5,050	154,100
16. Portland	35,400	12,750	8,500	4,450	2,600	63,700
Total	503,850	176,550	92,400	81,200	22,600	876,600
Percent of Total	57.48	20.14	10.54	9.26	2.58	100.00

1/ Less than 25 acres indicated.

Table 9.--Net volume of live sawtimber on National Forest commercial forestland by species and block, Ketchikan Working Circle, 1957.

Block	Species 1/					
	Hemlock	Sitka spruce	Alaska-cedar	Western redcedar	Other 2/	Total
	Accessible (M board feet Scribner)					
1. Kosciusko	1,454,092	822,282	52,325	112,474	3,912	2,445,085
2. El Capitan	3,357,538	1,447,031	100,727	260,064	3,591	5,168,951
3. Clam	309,653	175,108	11,143	23,952	833	520,689
4. Whale Pass.	2,642,002	1,137,104	77,104	200,471	4,858	4,061,539
5. Exclusion	103,379	58,460	3,720	7,996	278	173,833
6. Twelve Mile	2,327,612	1,005,111	69,931	180,533	2,377	3,585,564
7. Klawock	1,464,625	828,238	52,704	113,289	3,940	2,462,796
8. Skowl	1,395,287	780,878	49,253	105,960	3,682	2,335,060
9. Sukkwan	2,327,876	1,308,328	82,820	178,115	6,192	3,903,331
10. Union Bay	414,170	234,211	14,904	32,036	1,114	696,435
11. Cleveland	395,728	223,782	14,240	30,610	1,065	665,425
12. Neets Bay	1,213,862	523,401	36,489	94,168	1,227	1,869,147
13. Ketchikan	1,475,616	833,820	52,994	114,261	3,962	2,480,653
14. Behm	1,336,372	746,727	46,995	101,558	3,514	2,235,166
15. Boca de Quadra	1,267,563	707,051	44,616	95,996	3,336	2,118,562
16. Portland	898,103	507,465	32,251	69,548	2,411	1,509,778
Total	22,383,478	11,338,997	742,216	1,721,031	46,292	36,232,014
Percent of Total	61.78	31.30	2.05	4.75	0.12	100.00
	Inaccessible (M board feet Scribner)					
1. Kosciusko	498,084	230,451	28,600	29,826	12,779	799,740
2. El Capitan	396,190	285,080	37,398	35,210	2,190	756,068
3. Clam	65,542	31,146	4,008	4,103	1,791	106,590
4. Whale Pass.	395,704	281,628	36,534	34,675	2,329	750,870
5. Exclusion	798,622	379,505	48,834	50,004	21,819	1,298,784
6. Twelve Mile	297,272	220,791	29,877	27,512	1,326	576,778
7. Klawock	1,074,814	510,511	65,607	67,404	29,314	1,747,650
8. Skowl	1,126,235	534,230	68,408	70,941	30,565	1,830,379
9. Sukkwan	1,848,899	878,595	113,057	115,763	50,514	3,006,828
10. Union Bay	508,496	241,637	31,094	31,838	13,892	826,957
11. Cleveland	598,611	284,459	36,604	37,480	16,355	973,509
12. Neets Bay	175,856	127,545	16,866	15,789	926	336,982
13. Ketchikan	1,874,437	890,731	114,618	117,362	51,213	3,048,361
14. Behm	3,137,629	1,484,984	190,113	194,981	84,944	5,092,651
15. Boca de Quadra	3,016,435	1,427,392	182,703	187,391	81,634	4,895,555
16. Portland	1,182,488	556,163	70,681	72,463	31,581	1,913,376
Total	16,995,314	8,364,848	1,075,002	1,092,742	433,172	27,961,078
Percent of Total	60.78	29.92	3.84	3.91	1.55	100.00

1/ Volume distribution by species assumed the same on National Forest ownership as on all ownerships within each block.

2/ Includes lodgepole pine, true fir, and red alder.

Table 10.--Net volume of all timber on commercial forestland by class of material and species group, combined ownership, Ketchikan Working Circle, 1957.

Class of Material	Total	Softwoods	Hardwoods
	Thousand cubic feet	Thousand cubic feet	Thousand cubic feet
Growing Stock:			
Sawtimber trees:			
Sawlog portion	12,422,934	12,410,387	12,547
Upper stem portion	562,780	560,738	2,042
Total	12,985,714	12,971,125	14,589
Poletimber trees	610,047	608,630	1,417
Total growing stock	13,595,761	13,579,755	16,006
Other material:			
Sound cull trees	38,098	37,347	751
Rotten cull trees	421,899	421,753	146
Hardwood limbs	216	--	216
Salvable dead	241,566	241,566	--
Total other material	701,779	700,666	1,113
Total, all timber	14,297,540	14,280,421	17,119

Table 10a.--Net volume of all timber on accessible commercial forestland by class of material and species group, combined ownership, Ketchikan Working Circle, 1957.

Class of Material	Total	Softwood	Hardwoods
	Thousand cubic feet	Thousand cubic feet	Thousand cubic feet
Growing stock:			
Sawtimber trees:			
Sawlog portion	7,037,834	7,029,264	8,570
Upperstem portion	318,998	317,603	1,395
Total	7,356,832	7,346,867	9,965
Poletimber trees	346,657	345,240	1,417
Total growing stock	7,703,489	7,692,107	11,382
Other material:			
Sound cull trees	8,508	7,757	751
Rotten cull trees	291,877	291,765	112
Hardwood limbs	148	-	148
Salvable dead	153,270	153,270	-
Total other material	453,803	452,792	1,011
Total, all timber	8,157,292	8,144,899	12,393

Table 10b.--Net volume of all timber on inaccessible commercial forestland by class of material and species group, combined ownership, Ketchikan Working Circle, 1957.

Class of Material	Total	Softwood	Hardwood
	Thousand cubic feet	Thousand cubic feet	Thousand cubic feet
Growing stock:			
Sawtimber trees:			
Sawlog portion	5,385,100	5,381,123	3,977
Upper stem portion	243,782	243,135	647
Total	5,628,882	5,624,258	4,624
Poletimber trees	263,390	263,390	-
Total growing stock	5,892,272	5,887,648	4,624
Other material:			
Sound cull trees	29,590	29,590	-
Rotten cull trees	130,022	129,988	34
Hardwood limbs	68	-	68
Salvable dead	88,296	88,296	-
Total other material	247,976	247,874	102
Total, all timber	6,140,248	6,135,522	4,726

Table 11.--Net volume of live sawtimber on commercial forest land by species and diameter classes, Ketchikan Working Circle, 1957.

Species	Diameter Class (Inches d.b.h.)				Total	Percent
	11.0 to 20.9	21.0 to 30.9	31.0 to 40.9	41.0 & larger		
	M board feet (Scribner)					
Sitka spruce	1,584,063	3,386,254	4,844,920	10,329,420	20,144,657	30.72
Hemlock[1/]	10,645,914	14,378,368	10,839,216	4,351,593	40,215,091	61.33
Alaska-cedar	719,863	787,152	260,597	86,458	1,854,070	2.83
Redcedar	695,997	1,144,006	588,680	445,738	2,874,421	4.38
Lodgepole pine	26,465	8,199	-	-	34,664	0.05
True fir	75,087	143,646	181,730	-	400,463	0.61
Red alder	53,391	-	-	-	53,391	0.08
Total	13,800,780	19,848,625	16,714,143	15,213,209	65,576,757	100.00
Percent	21.04	30.27	25.49	23.20	100.00	

1/ Western hemlock and mountain hemlock combined.

Table 12.--Average net volume per acre in live merchantable trees on commercial forestland by land type and stand-size class, Ketchikan Working Circle, 1957.

Land Type	Stand-size class: Old Growth Sawtimber (4)	Young Growth Sawtimber (3)	Poletimber (2)	Seedlings & Saplings (1)	Non-stocked (5)
	Board Feet (Scribner)				
1. Accessible					
Blocks 2,4,6,12	34,923	39,061	3,796	--	--
Other Blocks	36,790	46,191	3,796	--	--
2. Inaccessible					
Blocks 2,4,6,12	31,889	39,061	3,796	--	--
Other Blocks	33,582	46,191	3,796	--	--
	Cubic Feet				
1. Accessible					
Blocks 2,4,6,12	7,337	8,509	1,717	--	--
Other Blocks	7,542	8,900	1,717	--	--
2. Inaccessible					
Blocks 2,4,6,12	6,767	8,509	1,717	--	--
Other Blocks	6,941	8,900	1,717	--	--

Table 13.--Gross and net sawtimber volumes, and volumes deducted for defect and breakage, by species, Ketchikan-Craig Working Circle, 1957.

Species	Gross volume of all live merchantable trees	Volume of defect in merchantable trees	Volume of breakage in merch. trees	Net merchantable volume
	Thousand board feet (Scribner)			
Sitka spruce	24,661,750	3,488,527	1,028,566	20,144,657
Hemlock	55,981,037	13,617,965	2,147,981	40,215,091
Alaska-cedar	4,079,756	2,123,325	102,361	1,854,070
Western redcedar	6,513,693	3,484,109	155,163	2,874,421
Lodgepole pine	43,425	8,054	707	34,664
Fir	431,312	18,463	12,386	400,463
Alder	62,291	6,897	2,003	53,391
Total	91,773,264	22,747,340	3,449,167	65,576,757
Percent	100.0	24.8	3.8	71.4

Table 14.--Total net volume by species and class of material, Ketchikan Working Circle, 1957.

Species	Live Merchantable			Sound cull	Rotten cull	Salvable Dead	Hard-wood Limbs	Total	Percent
	Sawtimber								
	Saw log	Upper stem	Pole timber						
	(Thousands Cubic Feet)								
Sitka spruce	3,218,270	156,452	52,697	1,198	35,510	30,606	-	3,494,733	24.4
Hemlock	7,906,461	336,592	458,424	21,263	155,928	196,415	-	9,075,083	63.5
Alaska-cedar	486,111	20,254	51,247	3,459	47,910	11,680	-	620,661	4.3
Western redcedar	729,648	44,301	44,667	11,427	182,364	2,596	-	1,015,003	7.1
Lodgepole pine	6,671	368	841	-	41	269	-	8,190	0.1
Fir	63,226	2,771	754	-	-	-	-	66,751	.5
Alder	12,547	2,042	1,417	751	146	-	216	17,119	.1
Total	12,422,934	562,780	610,047	38,098	421,899	241,566	216	14,297,540	100.0
Percent	86,9	3.9	4.3	0.2	3.0	1.7	-	100.0	

APPENDIX

EXPLANATION OF TERMS

Land-Use Classes

Forest land.--Includes (a) lands that are at least 10 percent stocked by trees of any size and capable of producing timber or other wood products, or of exerting influence on the climate or on the water regime; (b) land from which the trees described in (a) have been removed to less than 10 percent stocking, and which has not been developed for other use. (Forested tracts and islands of less than 10 acres and isolated strips of timber less than 120 feet wide are excluded.)

1. Commercial forest land - Forest land producing or capable of producing usable crops of industrial wood.

   a. Commercial accessible - Commercial forest land presently accessible and economically available now and which has not been withdrawn from use.

   b. Commercial inaccessible - Commercial forest land presently inaccessible and economically unavailable now and not withdrawn for specified purposes. Changing economic climate and improving logging methods probably will make portions available for development in the future.

   Commercial reserved - Commercial forest land withdrawn from timber utilization through statute, ordinance or administrative order. (Classed as noncommercial productive reserved by the Forest Survey).

2. Noncommercial forest land - Forest land incapable of producing usable industrial wood because of adverse site conditions and not withdrawn for specified purposes.

3. Noncommercial reserved forest land - Noncommercial forest land withdrawn for specified purposes through statute, ordinance or administrative order.

Nonforest land.--Includes land which has never supported forest growth; land from which the forest has been removed to less than 10 percent stocking and has been developed for other use, such as agricultural, residential, or industrial; all land in thickly populated urban and suburban areas; house sites; trade and manufacturing sites; lighthouse reserves; and water classified by the Bureau of the Census as land, i.e., less than 40 acres in size. Glaciers, ice fields, marsh land above mean high tide, permanent brush fields, muskegs less than 10 percent stocked to trees of any size and barren mountain tops are examples of lands which have never supported forest growth.

Forest types

Commercial forest types

Forest types are classified on the basis of the predominant species or species group that accounts for the major portion of the stand in terms of net board foot volume for sawtimber, cubic volume for poles and number of trees for seedling-sapling stands.

Sitka spruce.--Forests in which Sitka spruce is predominant.

Hemlock-Sitka spruce.--Forests in which 50 percent or more of the stand is hemlock but in which Sitka spruce makes up 30 to 49 percent of the stand.

Hemlock.--Forests predominately hemlock except when Sitka spruce comprises 30 to 49 percent of the stand.

Cedar.--Forests predominately western redcedar or Alaska-cedar, singly or in combination.

Hardwood.--Forests predominately cottonwood or red alder, singly or in combination.

Noncommercial forest types

Scrub.--Forests characterized by open stands of stunted, limby, defective trees of no present or prospective value. All tree species may be present. Mature stands will net less than 8000 board feet per acre (Scribner rule).

1. Stands occupy swamp-like soils and contain a dense understory of blueberry and other shrubs.
2. Stands at the upper limits of tree growth.
3. Stands within the altitudinal range of merchantable timber but occupying sites too rocky and too sterile to produce merchantable timber.

Class of Timber

Sawtimber trees.--Live trees of commercial species at least 11.0-inches d.b.h. with at least 25 percent of their gross board foot volume free from rot or other defect and that contain at least one merchantable sawlog. A merchantable sawlog is not less than 16 feet long, at least 6-inches d.i.b. at the small end for softwoods and 8-inches d.i.b. for hardwoods, and which after deductions for defect contains a net scale of 33-1/3 percent. However, for any log to be merchantable it must contain at least 20 board feet (Scribner rule). Merchantable height was based on the number of 16 foot logs in softwoods to a top d.i.b. of 40 percent of d.b.h., except in the case of small trees where the minimum top is 6 inches. For hardwoods it was the number of 8 foot logs to a minimum top of 8-inches d.i.b. for small trees and 40 percent of d.b.h. for large trees.

Poletimber trees.--Live trees 5.0-inches to, but not including, 11.0-inches d.b.h. These trees are of sufficiently good form and condition to indicate that they will grow into merchantable sawtimber trees.

Seedling and sapling trees.--Live trees of commercial species less than 5.0-inches d.b.h. and of sufficiently good form and vigor to indicate that they will grow into merchantable sawtimber trees.

Cull trees.--Live trees 5.0-inches d.b.h. and over that do not qualify as sawtimber or poletimber trees due to poor form, limbiness, rot or other defect.

1. Rotten cull trees contain excessive decay.
2. Sound cull trees have excessive crook, sweep or large limbs.

Salvable dead trees.--Standing dead sawtimber-size trees containing at least one merchantable sawlog and containing at least 50 percent of the tree gross board foot volume in sound material.

Hardwood limbs.--Limbs of hardwood sawtimber trees and sawtimber-size cull hardwood trees to a minimum diameter of 4.0-inches inside bark.

Stand-size Classes

Sawtimber stands.--Forest stands in which the minimum volume for coniferous types is 8,000 net board feet (Scribner) per acre in merchantable trees 11.0-inches and larger. For hardwood sawtimber stands the minimum volume is 4,000 net board feet (Scribner) per acre.

1. Old-growth.--Sawtimber stands in which the majority of volume is in sawtimber trees more than 150 years of age.

2. Young-growth.--Sawtimber stands in which the majority of volume is in sawtimber trees less than 150 years of age.

Poletimber.--Stands failing to meet the sawtimber stand specification, but at least 10 percent stocked with poletimber and larger trees, and with at least half the minimum stocking in poletimber trees.

Seedling and sapling.--Stands not qualifying as either sawtimber or poletimber, but having at least 10 percent stocking of trees of commercial species and with at least half the minimum stocking in seedlings-and-saplings.

Nonstocked and other areas.--Commercial forest land not qualifying for any other class.

Volume Estimates

Sawtimber volume.--Net volume in board feet, Scribner rule, of that portion of live sawtimber trees between stump and the upper limit of merchantability for sawlogs. Volume deductions were made for defects and breakage. Cull factors for hemlock, spruce and cedar were obtained from Station Paper No. 6, Alaska Forest Research Center. Cull for other species and breakage were cruiser's estimates.

Cubic-foot volume:

Growing stock.--Net volume in cubic feet of live merchantable sawtimber trees and live poletimber trees of commercial species from stump to a minimum 4.0-inch top (of central stem) inside bark.

All timber volume.--Net volume in cubic feet of live poletimber trees, live and salvable dead sawtimber trees and cull trees of commercial species from stump to a minimum 4.0-inch top inside bark. Includes also the volume of all hardwood limbs to a minimum diameter of 4.0-inches inside bark.

SPECIES TALLIED 1/

The following commercial tree species were tallied in the Ketchikan Timber Management Unit. Other tree species of minor importance may occur in this area, but unless they were tallied on the field plots they were not included in the following list.

	True firs	-Abies spp.
Softwoods:	Sitka spruce	-Picea sitchensis
	Hemlock	
	Western hemlock	- Tsuga heterophylla
	Mountain hemlock	- Tsuga mertensiana
	Alaska-cedar	- Chamaecyparis nootkatensis
	Western redcedar	- Thuja plicata
	Lodgepole pine	- Pinus contorta
Hardwoods:	Red alder	- Alnus rubra

FOREST SURVEY PROCEDURES

Area Estimate

The point sampling technique on 100 percent aerial photo coverage was used to obtain the various area statistics. A series of five sample plots were systematically located on each effective 1:40,000

1/ Little, Elbert L., Jr. Check list of native and naturalized trees of the United States (including Alaska). U. S. Dept. Agr., Agr. Handbook 41, 472 pp. 1953.

aerial photo of blocks 1, 3, 5, 7, 8, 9, 10, 11, 13, 14, 15, and 16. A series of 13 sample plots were systematically located on the photos of blocks 2,4,6,12. The 8902 plots that were established were sufficient to meet the requirements of an allowable sampling error of three percent of commercial forestland in terms of one standard error.

Each photo plot was then stereoscopically examined and classified as to forest or nonforest. The classification for each photo plot was determined on the basis of the 10 acre area including and immediately surrounding the plot. Plots classified as forest were then transferred to 18° oblique 1:20,000 aerial photos and a few 1:12,000 vertical aerial photos for more intensive forest examination. Next, the forest plots were classified as to commercial or noncommercial. Finally, the commercial forest plots were stratified by accessibility, forest type, stand-size and density classes. This procedure is known as stratification. The classified plots for each block were then summarized by stratum.

A sample of the plots were randomly selected and field checked. Field classifications were checked against the original photo classification for any differences in interpretation. The field check data was used to adjust the photo classification data for all of the plots in the survey unit if any differences occurred.

The detailed area data from the point samples was then expanded to the unit level. First, the known gross area of the unit was divided by the total number of photo plots to determine the number of acres represented by each. Then, the area for each stratum was a result of the product of the number of plots and the area represented by a plot.

To determine the accuracy of the office photo classification a sample of photo plots was checked in the field. A predetermined number of photos were selected at random and all of the plots on each photo, called a cluster, were examined. The number of photo clusters examined was determined by the formula: 1/

$$\left(\frac{S_{Paf}}{P_{af}}\right)^2 \left[\frac{\sum_{i=1}^{k} N_{if}\,(1-P_{if})}{\left(\sum_{i=1}^{k} n_{if}\right)^2}\right] + \left[C^2 n'_{if} + C^2 n'_{if} - 2r(n'_{if})(n_{if})C_{n'_{if}}\,C_{n_{if}}\right]\left[\frac{k-m}{k}\right]\frac{1}{m}$$

1/ Formula recommended by the late Roy Chapman, statistician, Washington office.

in which:

m = number of clusters to be checked

$\frac{S_{Paf}}{P_{af}}$ = relative error of proportion in commercial forest

k = total number of photos to give complete coverage

ni = number of points examined in the i-th cluster

n_{if} = number of points classed as commercial forest land

$C_{n_{if}}$ = coefficient of variation of the n_{if}

n'_{if} = number of points examined in the field

P_{if} = proportion in commercial forest land

$C'_{n_{if}}$ = coefficient of variation of the n'_{if}

$r_{(n'_{if})(n_{if})}$ = correlation coefficient between n_{if} and n'_{if}

Areas determined by photo-interpretation are corrected by applying a factor or ratio as determined from the comparison of photo and field classification of the random sample selected for field checking. A total of 50+ photo classifications were checked in the field.

Volume Estimate

A portion of the photo plots classified as commercial forest land were randomly selected for field examination. At the field locations, survey crews collected such data as species, diameters, merchatable heights, defect, mortality, stand-size class, forest type, etc., on three plots each one-fifth acre in size at two chain intervals.

The collected data was recorded in numerical code and sent to the Data Processing Unit at the California Forest and Range Experiment Sta. Data was compiled by IBM machines following the detailed procedures contained in "Plan for Compilation of the Alaska Forest Survey by the IBM Method". Briefly the procedure is as follows: All of the data recorded for each tree is punched on individual tree cards by location. Then the proper cull factor is applied to each tree. The trees are then sorted and data compiled by various classes such as by species, by 10-inch d.b.h. classes, by stand-size classes, by accessibility classes, etc. The tree volumes are then expanded to a per acre basis and per acre breakage factors by species applied to obtain net volume per acre. Net volumes per acre are then applied to area by classes to obtain class totals by timber management blocks.

Sufficient plots were selected at random to attain a specified level of statistical accuracy. The survey was designed for maximum efficiency in estimating total volume to meet the requirements of the Timber Management Division of Region 10 and the national survey. The allowable error for Region 10 requirement is 5 percent of total board foot volume per unit and for the national survey 10 percent per one billion cubic feet of growing stock for the Coastal Alaska sub-region.

The number of commercial forestland ground plots selected at random was debermined by using the formula:

$$E^2 = \frac{C^2}{n} + \frac{q}{mp}$$ 1/

where: E = allowable error
C = coefficient of variation
n = number of ground plots
p = proportion of photo plots on commercial forestland
q = proportion of photo plots on nonforest and noncommercial forestland

A total of 200 photo plots were examined on the ground.

Sample locations examined by timber management block, Ketchikan Working Circle, 1957.

Block	Photo plots	Ground locations	Check plots
1. Kosciusko	173	9	2
2. El Capitan	748	31	53
3. Clam	44	0	0
4. Whale Passage	649	23	36
5. Exclusion	134	4	5
6. Twelve Mile	664	20	43
7. Klawock	419	10	13
8. Skowl	449	11	18
9. Sukkwan	606	13	32
10. Union Bay	105	5	5
11. Cleveland	121	4	6
12. Neets Bay	286	14	15
13. Ketchikan	714	16	28
14 Behm	1528	17	55
15. Boca de Quadra	1356	15	51
16. Portland	906	8	32
Total	8902	200	394

1/ Formula recommended by Floyd Johnson, Statistician, Pacific Northwest Forest and Range Experiment Station.

ACCURACY OF THE ESTIMATES

Errors which affect the accuracy of the area and volume estimates in this report may arise from two sources:

1. Non-sampling errors.--These are human mistakes in judgment, measurement, recording, or arithmetic. There is no practical method of finding out just how often such errors occur. These errors are kept to a minimum, however, by a diligent effort to maintain a high degree of accuracy in the collection and compilation of data and closely checking all phases of the work.

2. Sampling errors.--These errors arise from using sampling procedures rather than making a 100 percent inventory. These errors can be measured. They are the only measurable errors involved in computing the reliability of the estimates.

Accuracy of the Forest-area Estimates

Forest-land class	All ownership Area	Sampling error
	Acres	Percent
Commercial accessible	1,067,850	± 1.9
Commercial inaccessible	890,750	± 2.1
Total commercial	1,958,600	± 1.4
Noncommercial	2,297,300	± 1.3

The probabilities are two out of three that the actual commercial forest land area is within ± 1.4 percent of the estimated area.

The sampling error for total commercial forest land was calculated from the formula:

$$SE = \frac{\sqrt{\frac{PQ}{n}}}{P}$$

P = proportion of commercial forest land
Q = 1 - P
n = total number of photo plots

Sampling errors of National Forest commercial forestland area by timber management blocks were calculated by the formula:

$$SE_a = \frac{SE_A}{\sqrt{\frac{a}{A}}}$$

SE_a = sampling error of any block

SE_A = sampling error of total CFL of the unit

A = total area of CFL in unit

a = area of CFL in any TM block

	Area Sampling Error, National Forest Commercial Forestland		
	Accessible	Inaccessible	Total CFL
	Percent	Percent	Percent
1. Kosciusko	± 7.6	± 12.7	± 6.5
2. El Capitan	± 5.2	± 13.1	± 4.8
3. Clam	16.8	35.0	15.2
4. Whale Passage	5.9	13.2	5.4
5. Exclusion	29.4	10.2	9.6
6. Twelve Mile	6.2	15.0	5.8
7. Klawock	7.6	8.6	5.7
8. Skowl	7.8	8.3	5.7
9. Sukkwan	6.0	6.6	4.5
10. Union Bay	14.2	12.8	9.5
11. Cleveland	15.0	11.8	9.2
12. Neets Bay	8.6	19.3	7.9
13. Ketchikan	7.6	6.6	5.0
14. Behm	7.8	5.0	4.2
15. Boca de Quadra	8.3	5.1	4.4
16. Portland	9.6	8.0	6.1

With each subdivision of the unit total, the percentage error increases so that small acreages may have large errors and therefore indicate only relative magnitudes.

Accuracy of the Timber Volume Estimates

Commercial forest	Volume	Sampling error
	M Bd. Ft. Scribner	Percent
Accessible	37,156,745	5.6
Inaccessible	28,420,012	6.4
Total	65,576,757	4.2

The probabilities are two out of three that the actual sawtimber board-foot volume is within ± 4.2 percent of the estimated total volume.

The sampling error for total volume was calculated from the formula:

$$E^2 = \frac{C}{n} + \frac{q}{mp}$$

E = sampling error
C = coefficient of variation
n = total No. of ground plots on commercial forestland
m = total No. of photo plots
p = proportion of photo plots on commercial forestland
q = 1 - P

Sampling errors of volume on National Forest commercial forestland by timber management blocks were calculated from the formula:

$$SE_v = \frac{SE_V}{\sqrt{\frac{v}{V}}}$$

SE_V = sampling error of total volume
V = total volume of working circle
v = volume of any block

Block	Volume Sampling Error - Ketchikan Working Circle National Forest Commercial Forestland					
	Accessible		Inaccessible		Total CFL	
	Percent		Percent		Percent	
1. Kosciusko	21.7		37.9		18.8	
2. El Capitan	14.9		39.0		13.7	
3. Clam	47.0		103.8		42.8	
4. Whale Passage	16.8		39.1		15.4	
5. Exclusion	81.4		29.7		27.9	
6. Twelve Mile	17.9		44.6		16.6	
7. Klawock	21.6		25.6		16.5	
8. Skowl	22.2		25.0		16.6	
9. Sukkwan	17.1		19.5		12.9	
10. Union Bay	40.6		37.3		27.5	
11. Cleveland	41.5		34.3		26.5	
12. Neets Bay	24.8		58.4		22.8	
13. Ketchikan	21.5		19.4		14.4	
14. Behm	22.7		15.0		12.5	
15. Boca de Quadra	23.3		15.3		12.8	
16. Portland	27.6		24.5		18.3	

With each subdivision of the Working Circle, the percentage error increases so that small volumes may have large sampling errors and therefore indicate only relative magnitudes.

COEFFICIENT OF VARIATION

The coefficient of variation as determined from the total field plots examined on commercial forest land was 52 percent. This was calculated on the basis of the net board-foot volume (Scribner) of live merchantable sawtimber trees.

TABLE OF SCRIBNER TO INTERNATIONAL ¼-INCH RATIOS

Species	10" - DBH Group	Ratio 1/
Western hemlock,	11.0" to 20.9"	1.16
Mountain hemlock and	21.0" to 30.9"	1.09
Sitka spruce	31.0" to 40.9"	1.05
	41.0" and larger	1.03
Alaska-cedar	all diameters	1.14
Western red cedar	" "	1.16
Lodgepole pine	" "	1.16
Hardwoods	" "	1.15

1/ Ratio for converting Scribner b.f. volume to International ¼-inch b.f. volume at the per acre level.

AVERAGE FORM CLASS, 16-FOOT LOG

Species	Form class
Western hemlock	82
Mountain hemlock	82
Sitka spruce	82
Alaska-cedar	79
Lodgepole pine	75
Hardwoods	77

CAUSES AND TYPES OF CULL 1/

Cull in living trees is largely due to decayed wood, but some may be due to sound defect from such causes as shake, crook, and sweep. Shake is the only sound defect that contributes appreciably to cull in the stands of Southeast Alaska. Loss of volume from burning, as found in large fire scars in other regions, is inconsequential in this rain forest. Sound cull from shake caused a loss of board-foot volume but was not considered a loss in cubic volume.

1/ Kimmey, James W.
1956. Cull factors for Sitka spruce, western hemlock and western red cedar in southeast Alaska. Station Paper No. 6, Alaska Forest Research Center.

Most board-foot cull and all cubic-foot cull was due to decayed wood. Decayed wood is of two types: "brown rot" and "white rot". In brown rot the casual fungi attack primarily the cellulose fibers; in white rot, the lignin content of the wood. Likewise, two general stages of decay were recognized in this study analysis. They are the early, or incipient, stage of decay and the late, or typical, stage.

In the incipient stage the affected wood is usually discolored and firm, but often somewhat softened and weakened. Low grades of lumber may be manufactured from such wood. This wood may also be used in pulp making, though some weakening of fiber results when incipient decay of the brown rot type is used. Wood in the typical stage of decay will not make lumber, even of low grade, and the typical stage of brown rot makes wood unsuited for pulp of any kind. Part of the wood containing typical decay of the white rot type, however, may be used in pulp making but with considerable loss of yield.

In the southeast Alaska study both brown and white rot, in both the incipient and typical stages, were considered to be cull; therefore, the cull factors discount all decayed wood. In certain uses for timber it may be desirable to know the type of rot or stage of decay likely to be found in the cull of a tree species. Table 1 shows for the various tree species the percentage of each type of rot in each stage of decay based on the cubic-foot volumes of cull found in the study trees.

Table 1.--Percent of white rot and brown rot in each stage of decay by tree species.

Tree species	White rot		Brown rot		All rot	
	Incip.	Typ.	Incip.	Typ.	Incip.	Typ.
Sitka spruce	27	73	39	61	37	63
Western hemlock	36	64	36	64	36	64
Western redcedar	77	23	57	43	77	23

If timber is to be used primarily for pulp, it will undoubtedly be desirable to know what percent of the total cull is caused by white rot and what part of the white rot is in the incipient stage of decay. Since all cubic-foot cull was caused by decay, the significance of each type of rot and each stage of decay in the total cull of a tree species can be read from table 2.

Table 2.--Percent of total cubic cull volume caused by each type of rot and stage of decay in each tree species.

Tree species	White rot			Brown rot		
	Incip.	Typ.	Total	Incip.	Typ.	Total
Sitka spruce	4	12	16	33	51	84
Western hemlock	22	40	62	14	24	38
Western redcedar	76	22	98	1	1	2

In western redcedar 98 percent of the total cubic cull was caused by white rot, of which 77 percent occurred in the incipient stage. In other words, more than three-fourths of the total cull in redcedar consisted of white rot in the incipient stage of decay--a type of cull material that may have limited use in both lumber and pulp manufacture.

GUIDES TO ACCESSIBILITY

A. Basic Assumptions
1. Market exists (on present economic and operability standards).
2. Minimum net volume yarding tree can support = 500 MBM.
3. Minimum of 16 M/A. net required immediately behind area that can be directly yarded to protected beach or truck road.
   a. Minimum set volume cold deck tree can support = 750 MBM.
   b. Maximum of one (1) cable swing from cold deck to yarding tree.
      thence (1) Directly to beach
      or (2) Truck to beach
      or (3) Cat swing to beach
   c. Well-spaced cold deck beach 100' x 150', or easily built.

B. Controlling Factors

SHOW	LOGGING METHOD	ROAD BUILDING FACTORS	MAXIMUM REACH 1/ Horiz. Level	(Photo) Dist. 50%	Dist. 100%	RATIO Slope Dist. /Horiz. 33'/ch. (50%)	66'/ch. (100%)	NOTES 2/
Large Valley	Road, with High Lead	Refer to Table (next page)	1000'	Yarding 900'	700'	1.1	1.4	
			1200'	Swinging 1090'	860'			
Gentle slope, beach front	Cat, or Donkey yard & cat swing	--	1000' 3/4 mi	900' Maximum	700'	1.1	1.4	Cat, 30% (20'/ch.) Max. Opera.
Beach Front	"A" Frame	--	2000'	1800'	1400'	1.1	1.4	
Steep Slope Beach Front	Skidder	--	2600'	2360'	1860'	1.1	1.4	40MMBM per show; protected H_2O

1/ Steep gullies, cliffs cause loss of deflection, cable wear, excessive breakage.
2/ Muskey-non-paying distance; shallow soil limits road bldg., spar trees, cats.

Road Building Accessibility Factors.

11/23/55

Av. Vol/A. 1/	Acres Timber Required at these Road Distances (miles)										
MBF	1/2	1	2	3	4	5	6	7	8	9	10
10	375	750	1500	2250	3000	3750	4500	5250	6000	6750	7500
20	187	375	750	1125	1500	1875	2250	2625	3000	3375	3750
30	125	250	500	751	1001	1251	1501	1751	2002	2252	2502
40	94	187	374	562	749	936	1123	1310	1498	1685	1872
50	75	150	300	450	600	750	900	1050	1200	1350	1500
60	62	125	250	174	499	624	749	874	998	1123	1248

1/ Av. cost logging road $ 30,000/mile; $ 4/MBF allocated for road building purposes. Weigh all factors - terrain, available gravel, muskegs, number spur roads, etc.

Multiply x 2/3 for easy road construction, x 5/3 for difficult road construction.

360° - Tree Maximum Reach Horiz. (Photo) Dist. feet	Theoretical acreage 1/	Ave. Net. Vol./Acre	Acreage Encompassed 500M 1/ per yard. tree	750M per cold deck tree
600	26	16	31	47
800	46	20	25	38
1000	72	30	17	25
1200	104	40	12	19
1600	185	50	10	15
2000	288	60	8	12
2400	415	70	7	11

1/ Reduce accordingly for fractions of tree, arc of reach of floating A-frames, etc.